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U. R. Gore and E. S. Luttrell[1]

SYNOPSIS

In this study, the earlier planting of Victorgrain oats for forage production resulted in increased severity of seedling blight and reduced stands. Both stands and forage yields were markedly improved by treatment of infested seed of poor quality with Ceresan or Panogen. Use of clean seed of good quality proved more effective than treatment of infested seed.

INTRODUCTION

Georgia farmers generally fail to appreciate the importance of using high quality oat seed, as is indicated by the difficulty in selling certified oat seed at even a slight premium. Apparently, the benefits of seed treatments also have not been sufficiently emphasized. There is no requirement in this State that certified oat seed be treated, and only a small percentage of the acreage in Georgia is planted with treated seed. With the expanding use of oats for winter grazing, plantings are being made far in advance of the normal planting dates for grain production in an attempt to obtain fall grazing as early as possible (3, 5, 6). There seems to be a tendency to consider seed quality and seed treatment of less importance in oats planted for forage than in oats for grain, although the difficulty in obtaining good stands and the severity of seedling blight are increased by warmer weather at the earlier planting dates (3, 5, 6). Victoria blight (*Helminthosporium victoriae* Meehan & Murphy) is the most important seedling disease (3, 4, 5, 6) because of the popularity of the susceptible Victoria oat derivatives. Tests with isogenic lines of oats have demonstrated that forage losses caused by Victoria blight may be as high as 80 percent (4). Such complete

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failures have been observed in the field in Georgia. Other diseases such as crown rust caused by *Puccinia coronata* Cda., seedling blight and leaf blotch caused by *H. avenae* Eidam (8, 9, 13), and seedling blight and culm rot caused by *H. sativum* Pam., King & Bakke (7) contribute to oat production problems. The relative importance of these diseases would vary with the choice of varieties. There is no acceptable variety with resistance to all diseases.

To meet this disease problem, tests were conducted at Experiment, Georgia, from 1955 to 1958 to determine the influence of seed quality, seed treatment, and planting date on stands and yields of oats. Data were obtained both on forage yields and on grain yields because oats are commonly grown as a dual purpose crop, being grazed until the first of March, after which they are allowed to produce a crop of grain.

MATERIALS AND METHODS

The oat variety Victorgrain 48-93 was used in all tests. This is the chief variety grown in Georgia, although it is susceptible to Victoria blight. For each test a lot of poor seed of low germination and low test weight harvested from fields of oats known to be infected with Victoria blight and a lot of good seed of apparently clean grain of high germination and high test weight were obtained for comparison. Percentage germination and percentage infestation with *Helminthosporium victoriae* were determined from replicated lots of 50 seeds each placed between layers of moist filter paper in large Petri dishes and held in a germinator at 20 degrees C. for 1 week. Seed sources for each year were as follows: 1955 - poor seed, from the Piedmont, germination 61 percent, *H. victoriae* 50 percent; good seed, from the Piedmont, germination 86 percent, *H. victoriae* 2 percent; 1956 - poor seed, from the Coastal Plain, test weight 22 pounds, germination 62 percent, *H. victoriae* 75 percent; good seed, from the Piedmont, test weight 38 pounds, germination 90 percent, *H. victoriae none;* 1957 - poor seed, from the Coastal Plain, test weight 22 pounds, germination 66 percent, *H. victoriae* 65 percent; good seed, from the Piedmont, test weight 35 pounds, germination 87 percent, *H. victoriae* 33 percent. Seed treatments were (a) control, no treatment; (b) Ceresan M dust at ½ ounce per bushel; and (c) liquid Panogen 15 at ¾ fluid ounce per bushel. Approximate planting dates were the first of September, middle of September, last of September, and the last week of October (Table 1). The

land on which these tests were planted was in a 4-year rotation. It was summer-fallowed each year prior to planting to conserve moisture, and a 4-12-12 fertilizer was applied at planting time at a rate of 500 pounds per acre. This was followed by top dressings of 50 pounds of N in the fall and 50 pounds of N at termination of clipping in the spring. Plantings were made in a randomized split-plot design with four replications at each planting date. Main plots of the two seed sources were divided into three subplots over which the seed treatments were randomized. Each subplot consisted of four rows 10 feet long. Seed was hand planted at the rate of 2 bushels per acre. Stand counts were made 2 or 3 weeks after planting before the seedlings started to tiller. All living seedlings in the two center rows of each plot were counted, and the average of the two rows was recorded. Forage yields were obtained from entire subplots. Clippings were made as forage was available. Green weights were recorded in the field, and dry weights were calculated on the basis of dried samples. Clipping was terminated about the first of March to permit grain production. Total grain and straw weights and weights of threshed grain were obtained for each subplot.

The data for stand counts and grain yields were analyzed statistically by years for a split-split-split plot design. Since plots for the last planting date in 1958 did not yield any forage, the forage data were analyzed within years. The standard error of the mean based on square root transformation is indicated in the tables.

RESULTS

Data on stand counts are shown in Table 1. With poor seed, stands were progressively reduced as the planting date was advanced. Untreated seed produced only 35 percent as many plants per row at the earliest planting date as at the latest planting date. Seed treatment doubled stands at the earliest planting date. Although seed treatment consistently increased stands at all planting dates, the percentage increases from treatment diminished with later planting as stands from untreated seed improved. At the last planting date the increase from treatment was only 23 percent. Ceresan and Panogen appeared to be approximately equal in effectiveness.

With good seed, stands were reduced by earlier planting, although not to as great an extent as with poor seed. Untreated good seed produced 52 percent as many plants per row at the first

Table 1. Effect of Seed Treatment and Planting Date on Stands from Good and Poor Seed of Victorgrain Oats.

Type of seed and treatment	Planting dates				Mean for seed type x treatment	Mean for seed type
	First Sept.	Middle Sept.	First Oct.	Last Oct.		
	Number of plants per 10-foot row					
Poor Seed	-----	-----	-----	-----	-----	131
Control	50	91	128	142	103	-----
Ceresan-M	95	130	173	174	143	-----
Panogen	106	142	172	174	148	-----
Mean for seed type x planting date	84	121	158	163	131	-----
Good Seed	-----	-----	-----	-----	-----	179
Control	111	159	200	198	167	-----
Ceresan-M	130	184	212	211	184	-----
Panogen	139	183	208	213	186	-----
Mean for seed type x planting date	127	175	207	207	179	-----
Mean for planting dates	105	148	182	185	-----	-----

Mean for treatment - Control, 135; Ceresan-M, 163; Panogen, 167.

Standard error of the mean based on square root transformation (by years).

Seed type - .04472
Seed treatment - .05389
Planting date - .15853
Seed type x seed treatment - .07622
Seed type x planting date - .08945

planting date as at the last. The increase from seed treatment was 25 percent at the first and 8 percent at the last planting date. These data were strongly influenced by results in 1957 when even the good seed were infested with *Helminthosporium victoriae*. In this year untreated seed produced only 46 percent as many plants per row at the earliest as at the latest planting date. Seed treatment increased stands 85 percent at the first planting and 15 percent at the last. In 1955 and 1956 when the good seed was free of *H. victoriae*, there were lesser reductions in stands with advancing planting date, and there was essentially no increase from seed treatment. In these 2 years untreated good seed consistently produced better stands than treated poor seed. In 1956 treated poor seed produced almost twice as many plants per row as untreated poor seed, while untreated good seed produced almost three times as many plants as untreated poor seed.

Forage yields (Table 2) approximated the pattern for treatments established by stand counts. With poor seed, treatment consistently increased yield means. Seed treatment nearly doubled yields at the earliest planting date, and for all planting dates over the 3-year period it produced an increase in average yield

of 60 percent. With good seed, treatment had little effect on yields, although the means in Table 2 include data from 1957 when the good seed was infested with *Helminthosporium victoriae*. In 1957 the increases in yields from treatment of good seed were of the same order as those from treatment of poor seed. In 1955 and 1956 untreated good seed produced much greater yields than treated poor seed. Forage yields were increased by earlier planting except in the case of untreated poor seed. Because of the severely cold weather during the 1957-58 season, oats made very little growth between the end of November and the first of March. In

Table 2. Effect of Seed Treatment and Planting Date on Forage Yield from Good and Poor Seed of Victorgrain Oats.

Type of seed and treatment	Planting dates				Mean for seed type x treatment	Mean for seed type
	First Sept.	Middle Sept.	First Oct.	Last Oct.		
	Pounds dry forage per acre					
Poor Seed	-----	-----	-----	-----	-----	1,405
Control	991	1,228	1,370	431	1,005	-----
Ceresan-M	1,913	1,941	1,836	737	1,607	-----
Panogen	1,940	1,936	1,693	851	1,605	-----
Mean for seed type x planting date	1,614	1,701	1,633	730	1,405	-----
Good Seed	-----	-----	-----	-----	-----	1,984
Control	2,023	2,197	1,975	1,308	1,876	-----
Ceresan-M	2,147	2,461	1,789	1,542	1,985	-----
Panogen	2,417	2,429	1,986	1,527	2,090	-----
Mean for seed type x planting date	2,196	2,362	1,917	1,459	1,984	-----
Mean for planting dates	1,905	2,031	1,776	1,094	-----	-----

Mean for treatment - Control, 1,440; Ceresan-M, 1,796; Panogen, 1,847

Standard error of the mean based on square root transformation (within years).

Seed type - 22.19
Seed treatment - 236.65
Planting date - 142.52
Seed type x seed treatment - 273.25
Seed type x planting date - 42.49

this year only yields from the first planting approximated those for the preceding 2 years. Yields from the second and third plantings were sharply reduced, and no clippings were obtained from the last planting.

Grain yields throughout the test period (Table 3) failed to follow any consistent pattern. They were completely confused in 1957-58 when growth of late plantings was slowed by cold weather and there was differential killing in earlier plantings as a result of freezes at the time the plants were recovering from clipping. A

definite response to seed quality and seed treatment was obtained only in the first planting in 1955 when grain yields from treated poor seed and from good seed were 38 to 46 percent greater than from untreated poor seed.

Table 3. Effect of Seed Treatment and Planting Date on Grain Yield from Good and Poor Seed of Victorgrain Oats.

Type of seed and treatment	Planting dates				Mean for seed type x treatment	Mean for seed type
	First Sept.	Middle Sept.	First Oct.	Last Oct.		
	Bushels per acre					
Poor Seed	----	----	----	----	----	67
Control	62	66	68	56	63	----
Ceresan-M	58	64	82	65	67	----
Panogen	64	68	82	67	70	----
Mean for seed type x planting date	61	66	77	63	67	----
Good Seed	----	----	----	----	----	70
Control	64	71	74	67	69	----
Ceresan-M	62	66	84	77	72	----
Panogen	53	68	82	73	69	----
Mean for seed type x planting date	60	68	80	72	70	----
Mean for planting dates	60.5	67.2	78.5	67.5	----	----

Mean for treatment - Control, 66; Ceresan-M, 69; Panogen, 69

Standard error of the mean based on square root transformation (by years).

Seed type - 1.055
Seed treatment - 1.269
Planting date - 1.836
Seed type x seed treatment - 1.795
Seed type x planting date - 2.11

DISCUSSION

Results of these tests confirm previous reports (3, 4, 5, 6) which indicate that seedling blight and difficulties in obtaining adequate stands of oats are increased by earlier fall planting for winter forage production. They emphasize the fact that seed treatment and the use of clean seed of good quality are of even greater importance in early plantings for forage than in later plantings for grain. Higher temperatures at the earlier planting dates favor the development of seedling blight (3, 4, 5, 6, 11) and also increase the physiological stress on the plants since they are less favorable for the germination of seed and the growth of seedlings of blight resistant varieties (6). Seed treatment is essential when seed are obviously of poor quality or are known to be infested. Since the primary purpose of seed treatment is to pre-

vent the introduction of pathogens by eliminating seed-borne organisms, the same end may be attained more effectively by the use of clean seed. Use of seed of good quality has the additional advantage of increasing germination and seedling vigor. Consequently, the use of high quality, clean seed is of greater importance than seed treatment in increasing stands and forage production. Little response to treatment could be expected from clean seed. Results in 1957-58, however, demonstrate that bright, apparently clean seed may be infested. It would, therefore, be simpler to treat all oat seed routinely than to base treatment on a determination of the degree of infestation of each lot of seed.

Ceresan M and Panogen 15 were of approximately equal effectiveness in controlling Victoria blight and in increasing stands and forage production from infested seed. Because of their vapor action (2), these materials are effective in the control of smut (10, 12) as well as Victoria blight (1, 10). The dust treatment with Ceresan M is more convenient for the individual grower. The liquid treatment with Panogen 15 offers advantages to the seed processor with adequate equipment for its application.

These tests were planted in a 4-year rotation of cotton, corn, small grains, and soybeans, with winter crops of crimson clover or winter peas for cover or seed. Benefits from the use of clean seed or seed treatment may be reduced in plantings on land continuously in oats on which there is a buildup of soil infestation with pathogenic organisms. Elimination of pathogens in infested soil by fumigation has produced greater increases in oat forage yields than seed treatment (9). The importance of rotation in conjunction with seed selection and seed treatment, therefore, cannot be emphasized too strongly (3), although the difficulty of establishing an adequate rotation is recognized in situations in which there is a heavy demand for early winter grazing and suitable land conveniently located for this purpose is limited.

Data on forage production, which show increased production with earlier planting dates, represent total production to the first of March and provide no indication of seasonal distribution (3). Since earliness of forage production may be of greater importance than total production, this factor also must be considered in determining the most desirable planting date. Recommended planting dates are the middle of September in the Georgia Piedmont (5, 6) and the first of October in the Coastal Plain (3). Data for 1957 demonstrate the advantage of early planting for forage production in years of cold winters.

The slight effect of seed quality and seed treatment on grain production may be partially explained by the fact that there was little damage to the culms from Victoria blight during the spring. Such damage often is an important factor, especially in South Georgia.

SUMMARY

Tests on Victorgrain 48-93 oats were conducted at Experiment, Georgia, over a period of 3 years from 1955 to 1958 to determine the effect of seed quality, seed treatment, and planting date on stands and yields. In each year a comparison was made between (a) lots of good, apparently clean seed and lots of poor seed infested with *Helminthosporium victoriae;* (b) seed treatment with Ceresan M and Panogen 15 and no treatment; and (c) plantings on four dates from the first of September to the last of October. Earlier planting progressively increased the severity of seedling blight and the difficulty of obtaining adequate stands and forage yields. At the earliest planting dates seed treatment of poor, infested seed doubled stands and nearly doubled forage yields. Use of clean seed produced greater increases than treatment of poor seed. Although the use of clean seed of high quality is of primary importance, routine treatment of all oat seed is recommended because of the difficulty in determining the degree of infestation of each lot of seed. Seed selection and seed treatment are of greatest importance in early fall plantings of oats for forage. The data obtained revealed no consistent effect of seed quality, seed treatment, or planting date on production of grain following termination of forage clipping on the first of March, although responses to seed quality and seed treatment were evident when stands were poor enough to leave skips in the rows.

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